

PROBLEMS OF RIVER EROSION IN MAJULI, ASSAM, INDIA: A GEO-ENVIRONMENTAL ANALYSIS

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ABSTRACT

River bank erosion is an important problem causing land loss and catastrophic flood. Majuli is the world's largest river island with cultural hub of Assam has been facing great threat due to the environmental and social consequences of bank line erosion. Along with the problem of bank line erosion, problems of acute flood, sand casting, embankment breach, road breach have been tormenting life in Majuli. Erosion in Majuli results due to lateral movement of the bank lines. Therefore to assess the riverbank erosion it is necessary to study the channel platform change over time. The present study is an attempt to investigate the social and environmental causes and consequences to understand the problem of river bank erosion in the Majuli island. To fulfil the aim, the study has been done very systematically and data has been collected in scientifically from both primary and secondary sources. Data are analysis through statistical techniques. The findings reveal that Majuli has been observed to be shrinking in due course of time. River channels are susceptible to change in their course and dimension over time and space.

KEYWORDS: Bank line, Erosion, Majuli, River Bank

INTRODUCTION

River bank erosion is not only associated with the threat that it possess towards life, infrastructure and agricultural land located near the river bank, but also is an significant threat towards the habitat in and around the riverine ecology. Bankline erosion in the banks of Brahmaputra-Barak rivers of Assam is due to high flood discharge in the river, bed slope and composition of the bed and bank materials [1]. Bank erosion causes lateral widening which is a significant geomorphic process in a river of large lateral dimension like Brahmaputra. The lateral widening which occurs is generally caused by erosion and deposition around the banks. Heavy down pore in the form of rain, brings down more water than can be disposed by combined factors natural and manmade systems causes flooding.

The rivers overflow embankments may be Breached [2] Generally, bank erosion is a process commonly associated with migrating meandering streams or laterally shifting streams. Migrating streams tend to erode the banks and widen the channels by undercutting the bank having the eroded materials is then washed away by the flow. Bank migration leading to lateral widening of the banks and in due course this erosion takes a toll upon the banks. The composition and characteristics of the bank materials and presence of vegetative cover determine the erosion rate. The deposition within the river bed and banks causing sandbars are the reason behind intense braiding of the channel. Bank erosion is termed to be a function or hydraulic character of flow and properties of bank materials. These factors of fluvial processes of the river shape the weak bank line and its migration around the island. The drastic changes caused by these channels observed in the erosion prone areas along the river indicate the dynamic nature of river morphology and the intense of erosion caused by it.

The island of Majuli is situated at the bosom of three river systems, i.e, Subansiri, Kherakhutia suti and the main Brahmaputra [1]. Majuli forms the part of the floodplains of Brahmaputra river, thereby continuously facing serious problems of bank line erosion which has posed a threat to its rich cultural heritage and its existence as well. The severity of the problem can be quite specifically be depicted in case of the Majuli island, the largest inhabited riverine island of the world. Previous works from various geomorphologists reveal that the rate of bank erosion has been increasing at an alarming rate. Therefore, the present study attempts to investigate the state of river bank erosion and few necessary measure needed to be implemented for the recovery from this threat be coupled with improvement of rice production in the region, thus to reduce food insecurity within inhabiting population.

METHODS

The main aim of this paper is to study the areas in and around the susceptible to bank line erosion and to understand the extent of erosion grasping the Majuli island. Finally the study suggests some protective measures for reducing the impact. To fulfill the aim o the paper some methods has been applied. The methodology adopted to study the bank line erosion problem necessitated the use of primary and secondary data. The observation has been confined within the study area of Majuli. The study being geographical, both primary and secondary data have been collected in order to arrive at a clear conclusion. From actual visit of the study area and interactions with the inhabitants, the problem of erosion and its effect upon the people are studied.

Secondary information were also collected from various sources like Water Resource Department, Central Ground Water Board. Satellite images of the study area are also used to make the land use/ land cover of the catchment area.

Finally, the conclusion of the study have been drawn on the basis of the findings derived from the analysis of both primary and secondary data and also from personal observations in the field and report was prepared on the basis of all data collected from the field.

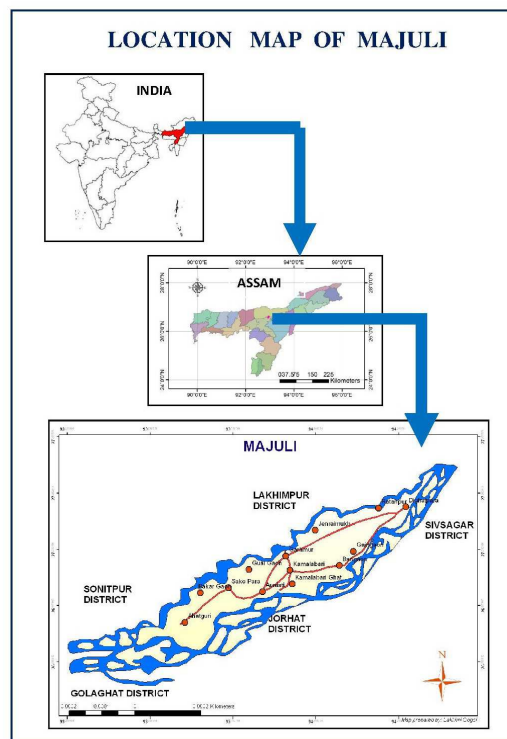
Based on the observations derived from the field study, the report was prepared and conclusions were drawn.

RESULTS AND DISCUSSIONS

The island of Majuli is formed by the Brahmaputra river in the south and the Kherkutia Xuti, an anabranch of the Brahmaputra, joined by the Subansiri River in the north.. The island is about 200 kilometres east from the state's largest city —Guwahati. The island was formed due to course changes by the river Brahmaputra and its tributaries, mainly the Lohit . Majuli is also the abode of the Assamese neo-Vaisnavite culture. The geographical extent of the study area (Map .1) is $26^{\circ}45' \text{ N}$ - $27^{\circ}12' \text{ N}$ latitude and $93^{\circ}39' \text{ E}$ - $94^{\circ}35' \text{ E}$ longitude with mean height of 84.5 m above MSL. Majuli, bounded by the river Subanisri on the northwest, the Kherkatia Suti (a spill channel of the river Brahmaputra) in the northeast and the main Brahmaputra river on the south and the south west is regarded as the largest fresh water inhabited island of the world.

Water yield of the Subansiri is 0.076 cumec/km² [3]. Majuli is a part of the great alluvial tract of the Brahmaputra river and geomorphologically it forms a part of the Brahmaputra floodplain. Being an active floodplain, the presence of alluvial features such as natural levees, crevasses, splay deposits, point bars, channel bars etc are significant.

Originally, the island was a narrow and long piece of land called “Majoli” (land in the middle of two parallel rivers) that had Brahmaputra flowing in the north and the Burhidihing flowing in the south, till they met at Lakhui. Frequent earthquakes in the period 1661–1696 set the stage for a catastrophic flood in 1750 that continued for 15 days, which is mentioned in historical texts and reflected in folklore. As a result of this flood, the Brahmaputra split into two anabranches—one flowing along the original channel and the other flowing along the Burhidihing channel and the Majuli island was formed. The Burhidihing's point of confluence moved 190 km east and the southern channel which was the Burhidihing became the Burhi Xuti. The northern channel, which was previously the Brahmaputra, became the Luit Xuti. In due course, the flow in the Luit Xuti decreased, and it came to be known as the Kherkutia Xuti; and the Burhi Xuti expanded via erosion to become the main Brahmaputra River.



Map 1: Location Map of Majuli

Majuli is culturally as well as naturally rich island in the world. Rich biodiversity and colourful culture of the satra always attracts the tourist to Majuli. The people found in the Majuli are normally schedule cast and schedule tribe people. The schedule tribe population in the area is 44 % whereas schedule cast is 14% and other people are 42% (Figure 1). The main occupation of these people are normally primary occupation such as cultivation, rearing. Now river bank erosion is posing a burning problem to the people of Majuli. From the study of the entire area, it is evident that the village Salmora, Sukhunamukh, Upper-Sonowal, Korotipar, Malowal, Ukalchuk villages are continuously facing severe problems of riverbank erosion.

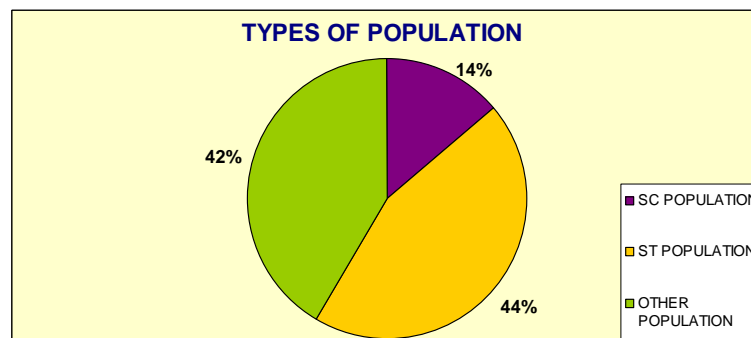


Figure 1: Types of Population

The literacy rate in Majuli is 73.9 % and among this 57.18 % are male and 39.79% are female (Figure 2). As the area is flood inaundered area people faces different problems in their livelihood. No industrial function has been seen in the area due to different types of disadvantages. The working pattern in Majuli is shown in figure 3.

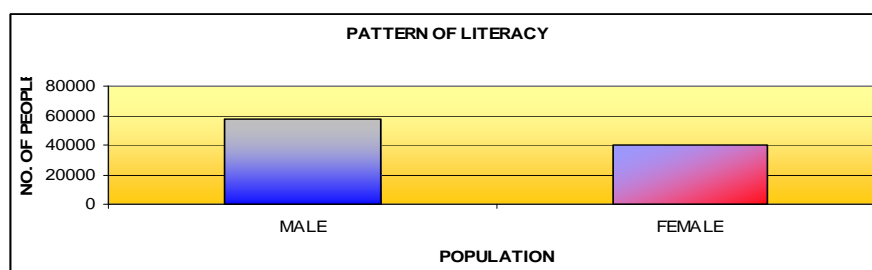


Figure 2: Pattern of Literacy

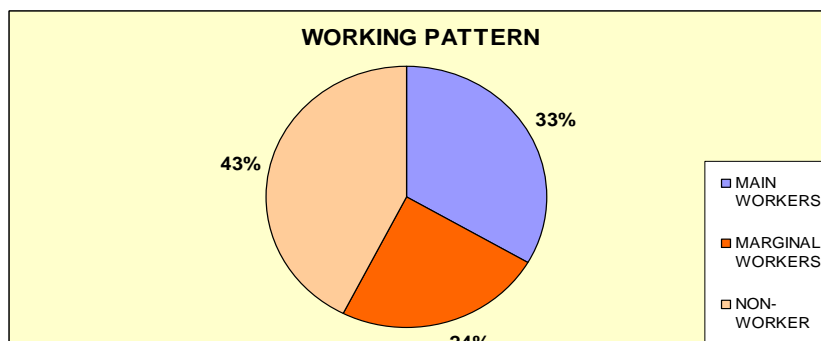


Figure 3: Working Pattern

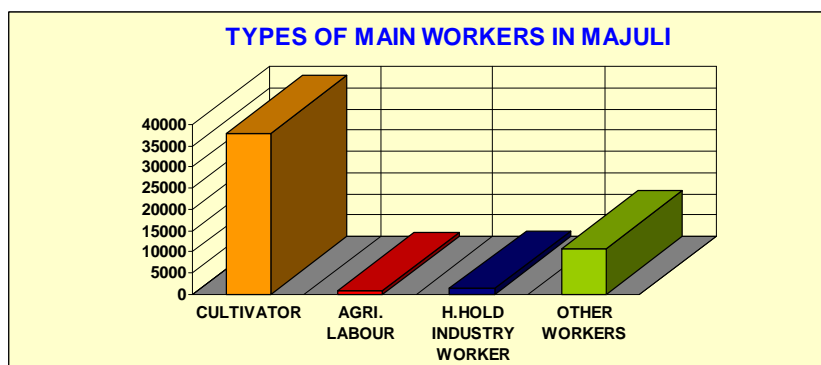


Figure 4: Types of Main Workers in Manjuli

The figure 4 shown the types of main workers in Majuli. In Majuli 74 % people are cultivator and 21% are other workers, 3% are house hold industry worker and 2% are agricultural labour respectively.

Majuli is seriously affected by erosion of the Brahmaputra and the Subansiri rivers. The extreme braided nature of the Brahmaputra coupled with silt and sand strata of the banks is the main cause of erosion. Erosion in this area was not much before the 1950 earthquake of magnitude 8.6 Richter scale but became active thereafter and attained serious dimension after the 1954 flood. Porcupines are being used to control erosion only at a few places, but it has not been found to be effective (Plate 3). The area of the island has been reduced from 706.14 km² in 1966-1975 to 578.38 km² in 1998 and to 484.34 km² in 2008. Space Application Centre (SAC) and Brahmaputra Board (1996) jointly studied the river erosion problem of Majuli Island and identified the areas of the island which have undergone changes along the bankline due to erratic behavior of the river. Brahmaputra Board [4] prepared a report where the area of the island was mentioned to be 925 km² in 1971. The erosion is a serious problem which threatens the existence of Majuli-one of the oldest cultural heritage site of Assam. Sarma and Phukan [5] gave a comprehensive account on the origin and geomorphological changes including erosion and deposition in Majuli Island. Kotoky et.al [6] studied the erosion and deposition of the island from 1914 to 1998 and revealed that the extent of erosion and deposition was not same for the period 1914–75 and 1975–98. The aim of this present study is to evaluate the migration of the rivers Brahmaputra and Subansiri, the locations of erosion and deposition and the rate of erosion and deposition in the island starting from 1966-1975 to 2008.

The island is under threat due to the extensive soil erosion on its banks. The reason for this magnitude in erosion is the large embankments built in neighbouring towns upriver to prevent erosion there during the monsoon season when the river distends its banks. The upshot is a backlash of the tempestuous Brahmaputra's fury on the islet, eroding most of the area. According to reports, in 1853, the total area of Majuli was 1,150 km² and about 33% of this landmass has been eroded in the latter half of 20th century. Since 1991, over 35 villages have been washed away. Surveys show that in 15–20 years from now, Majuli would cease to exist.

It is observed that, the area eroded in different time periods and the annual average rate of erosion is different. The annual average rate of erosion in different time intervals are-

Table 1: Annual Average Rate of Erosion

Year	Area of Erosion
1972- 2001	6.92 km ² / Year
2001-2004	2.47 km ² / Year
2004-2008	5.48 km ² / Year
2008-2010	3.34 km ² / Year

The consequences of bank erosion and shrinking size of the island over the years ranges from acute pressure on the existing land to population redistribution, out-migration, changes in occupational structure, increasing levels of poverty etc. The consequences of these are never uniform either spatially or socially. People living in the hazard prone areas are affected more by the process of erosion than those living far away. Likewise people with poor economic base face more adverse consequences of the bank erosion than those with better access to resources and income.

Measures for Conservation

Majuli island, the shrinking landmass, is extremely erosion prone area, demands urgent remedies. Every year loss

of lives and cropped areas are affected by severe erosion. Bank line migration of the river Brahmaputra and its tributary in Majuli has thus created an acute socio-economic problem in the area. Anti-erosion measures adopted by the Government are proved to be not truly effective.

The average annual rate of erosion per unit length from 1998-2008 was much higher than that of the period 1966-1975 to 1998. An average annual rate of erosion per unit length of 0.074 km²/km was observed during the period 1966-1975 to 1998 where as higher average rate of erosion rate of 0.178 km²/km was observed during the period 1998- 2008. The present erosion rate was more than double that of the previous years. Thus, the erosion of the world's largest inhabited river island Majuli should be considered as a national problem and should be addressed in time to stabilize ecological balance [6].

To save the island, the Union Government of India has sanctioned 250 crores for the protection of the island. The water resource department & The Brahmaputra Board are struggling to solve the erosion problem of this island for the last three decade but without much success. Recently it is suggested that a four lane Highway protected by concrete mat along the southern boundary of Majuli & excavation of river bed of the Brahmaputra River, only can solve the problem . This Project, namely The Brahmaputra River Restoration Project is yet to be approved by the Government. However a nomination has been sent to the UNESCO for the declaration of Majuli to be as a world heritage site. The government has initiated the efforts to save Majuli from the ravages of the Brahmaputra. Majuli is currently in the tentative list of UNESCO World Cultural Heritage Sites and is undergoing scrutiny as a World Cultural Heritage Site. Moreover plantation of porcupines and breaches along the banks may protect the loose banks from the forceful erosive power of the river. Sandbags, large bags of concrete materials, are laid along the highly erosion prone banks of the island is a protective measure.

Government adopted various erosion control projects to protect the area and lives of the people. Furthermore the government should take immediate and necessary measures for vulnerability and risk analysis of the area.

CONCLUSIONS

The Brahmaputra river is a mighty river causing various flood, flash flood, river bank erosion and sand casting. Majuli too is not an exception as it durinally suffers these environmental consequences. The grasp of nature has been tormenting the poor inhabitants of the island. After thorough analysis of the results and field survey, it is concluded that the problem of river bank erosion in the area is of serious concern as the people living here are periodically susceptible to loss of life and properties. The erosion has caused a dramatic change in reduction of land area of the Majuli Island. The land area as evidenced till 1966-1975, 1998 and 2008 were 706.14, 578.38 and 484.34km² respectively. The total average annual rate of erosion and deposition covering the entire period were 8.76 km²/yr and 1.87 km²/yr. It can clearly be attributed that the island mass suffered significant rate of erosion than the depositional processes. [6]

The foregoing study concludes that the position of the study area is severe. Although to completely mitigate the effects of these fluvial processes is not possible, while some remedial measures can be implemented. Thus some suggestions to conquest this fist of nature as well as to minimise the impact of the toll of nature is needed to be implemented. The first and foremost strategy needed to be urged is to develop a strong awareness programme about importance of trees and afforestation. Afforestation reduces soil erosion and as a result flood and bank erosion problems may also be reduced to a certain extent. Approximate soil conservation measures in the upper catchment area to check

bank erosion need to be intensified. Involvement of the community will help in achieving success in such measures. The most possible measures for control of flood and bank erosion stated to the construction of dams and taming of rivers. Studies are needed on the rivers and the tributary system.

The fresh water river island Majuli have suffered a significant rate of erosion since historical time [6]. The study findings therefore emphasise on an urgent need to develop an effective spatial plan considering all the aspects of river bank erosion and to protect the heritage site from further engulfing the two river systems.

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APPENDICES



Plate 1: Erosion Sites near Afalamukh



Plate 2: Extensive Erosion near Kamalabari



Plate 3: Protective Measures for Erosion in the Banks